

Community Enterprises—An Institutional Innovation

Bruno S. Frey^{a,b,c,*}, Roger Lüthi^d and Margit Osterloh^{a,c,d}

^a*Warwick Business School, The University of Warwick, Coventry, UK*

^b*Department of Economics, University of Zurich, Zurich, Switzerland*

^c*Center for Research in Economics, Management and the Arts (CREMA), Basel, Switzerland*

^d*Department of Business Administration, University of Zurich, Zurich, Switzerland*

Management research has focused on for-profit firms. Recently Wikipedia and Linux have emerged that we call Community Enterprises. They are not-for-profit organizations producing innovation resources and making them freely available. They collide with firms, which aim at acquiring control of resources. Although contributing substantially to the economy, they suffer from not being able to quantify their contributions adequately. We analyze them as aliens in the market economy and to the theory of the firm, discussing which measures must be applied to ensure their activities, and which assumptions must be revised to encompass their potential as a source of economic value. Copyright © 2012 John Wiley & Sons, Ltd.

1. WIKIPEDIA AS A NEW FORM OF ENTERPRISE

If you search the Internet for information, you will likely be pointed to Wikipedia. Whether you are interested in the ‘Iraq war’, the ‘financial crisis’, ‘transaction costs’, or ‘lysergic acid diethylamide’, the probability is high that Wikipedia articles appear prominently in the results of the most commonly used Internet search engines. Market researchers have ranked the Internet encyclopedia among the top 10 most popular websites; among news and information sites, it is the undisputed leader. As a freely accessible Internet encyclopedia, a public platform for the integration of knowledge, and a central information hub for current events and controversial topics, it provides benefits that did not previously exist. Because its size and scope has expanded beyond any other encyclopedia, Wikipedia has had a marked effect on the market for encyclopedias. Wikipedia is

the most prominent example of a new form of enterprise whose contributors and users have been increasing dramatically. This innovation goes beyond Wikipedia and involves projects such as Linux, Apache, Eclipse, OpenStreetMap, and RepRap. We call this new form a ‘Community Enterprise’ (CE). Some of these enterprises are considerably large: A thousand individuals work on the Linux kernel and tens of thousands contribute to Wikipedia.¹

The general characteristic of CEs is that they are private organizations that produce public goods entailing a new production process in a barrier-free social community. They contribute to the economy not only through the utility value of the goods they produce, such as an encyclopedia, Web server software, or a geographical database. More importantly, they enable further innovation by contributing to an economic ecosystem that is open to everyone. This community is organized in a polycentric, overlapping way with self-defined rules. It is designed to prevent anyone, including the community itself, from gaining control over the resources it develops.

*Correspondence to: Department of Economics, University of Zurich, Zurich, Switzerland. E-mail: Bruno.frey@econ.uzh.ch

Community Enterprises are different from any other organization that we know. They are not firms, markets, or networks (Demil and Lecoq, 2006). They are also not organizations like self-organized commons (Ostrom, 1990) or open innovation projects such as InnoCentive (Jeppesen and Lakhani, 2010), NineSigma, or InnovationXchange. These open innovation enterprises draw from large crowds of loosely affiliated researchers, but, in stark contrast to CEs, they acquire control over technology through the rewards they offer. The non-exclusive sharing of produced resources, in particular generative technologies, the lack of control, and the lack of boundaries between the CE and its environment are the main distinguishing properties of CEs.

With these characteristics, CEs challenge common wisdom. According to orthodox economics, CEs should not even exist as they produce public goods without central planning and control, and no private property rights are assigned. CEs show that some resources are most productive exactly when no property rights are attached to them. Unfortunately, their value is not captured by standard economic performance indicators. Moreover, CEs are aliens to the theory of the firm. They do not fit into the central question of this theory: what determines the boundaries of the firm? Consequently, CEs are mostly ignored in the literature on the theory of the firm (e.g., Zenger *et al.*, 2011).

Community Enterprises have been the subjects of published research in the past decade, for example, in computer science (e.g., Müller and Gurevych, 2009), law (e.g., Benkler, 2002), history (e.g., Rosenzweig, 2006), information systems (e.g., Hansen *et al.*, 2009), management and innovation research (e.g., Osterloh and Rota, 2007), and economics (e.g., Lerner and Tirole, 2002). The first and major stream of literature in economics, management, and innovation research analyzes such projects from the perspective of profit-seeking firms. Typical research interests are the competitive advantage of firms (e.g., von Krogh and von Hippel, 2006; Gächter *et al.*, 2010), conditions under which it makes sense for firms to cooperate with CEs (Henkel, 2006; Dahlander and Magnusson, 2008), what firms can learn from CEs (Baldwin and von Hippel, 2009), and how firms deal with conflicts between them and CEs (Lee and Mendelson, 2008). The second stream of literature studies CEs and similar forms of cooperation in their own right. Most notably, Benkler (2004) describes conditions that enable 'commons-based peer production', a large-scale cooperation where no one uses exclusive rights to organize effort or capture its value. Finally, a third stream of literature promotes

concepts that limit control over resources that are needed for further innovation (Lessig, 2004; Boyle, 2008; Zittrain, 2008; Wu, 2010).

We add to the second and third stream of literature by analyzing how and why the characteristics of CEs inevitably lead to conflicts with firms over control of resources that are needed for further innovation. Conflicts with firms arise mainly because CEs operate by different rules than firms. They are aliens to the market economy. As we will elaborate, CEs break standard assumptions about competitive strategies. Conversely, firm behavior can create existential threats for CEs.

In dealing with those conflicts, CEs obtain little support from economics and management research. Although firms, consumers, and academia benefit greatly from CEs, the value of their contributions is not measurable by firms' profits, GDP, or employment rates. Unlike public goods provided by the government, public goods produced by CEs cannot even be measured by input factors such as costs. They are produced either by volunteers or by companies contributing to CEs, which do not publish the relevant numbers. Unfortunately, 'in the social sciences often that is treated as important which happens to be accessible to measurement' (von Hayek, 1975, p. 434). Also, in management research, it is common that only those variables that can easily be measured are studied, producing the paradox that novel phenomena are more concealed than illuminated (Bennis and O'Toole, 2005; Corley and Gioia, 2011). This becomes a major handicap for CEs as a research topic as well as a subject in the political process because economic models and measures underlie much of public policy.

In this paper, we contribute to an analysis of CEs as a competitive force to firms. We do so by analyzing the key characteristics of CEs (Section 1). We then show that important actors, such as firms, consumers, and academia, benefit from CEs but do not support them or even oppose the principles underlying CEs (Section 2). Finally, we discuss implications for theory building (Section 3) and public policy (Section 4). We find that dominant theories hinder rather than support this new phenomenon and that policy proposals trying to achieve the benefits of CEs by regulating rarely are effective. We suggest a shift in innovation policy in favor of CEs and the enormous economic value they create. This shift proposes that governments support CEs primarily by acting as buyers, sponsors, and producers of goods that are enabled and provided by CEs.

2. CHARACTERISTICS OF COMMUNITY ENTERPRISES

Community Enterprises differ from firms as studied in traditional management research and the theory of the firm with respect to a combination of what, how, and why resources are created. CEs are close to Benkler's (2006) commons-based peer production. However, the focus of our analysis is not a mode of production, but enterprises with a purpose and an identity that are aliens in the market economy and as such fierce competitors to for profit firms.

2.1. What Kinds of Resources Are Produced in Community Enterprises?

Community Enterprises are special for the resources and the products that they provide. They produce public goods—information goods and at the same time innovation resources that are free to build upon by everyone.

Community Enterprises produce information goods that are non-rivalrous in consumption. In principal, such resources could be excluded by law (e.g., by copyrights). However, CEs offer barrier-free access as a matter of principle. It is their choice to turn innovation resources into public goods. Standard open licenses (e.g., copyleft licenses such as the GNU General Public License) codify this principle for a variety of purposes and concerns. Best known for their use is free and open source software (FOSS) but the range of available open licenses also covers cultural works, databases, and hardware design.

The most obvious aspect of CE output are products that are available to everyone at no cost. More importantly, a CE produces not only for consumers, but also for producers. First, CEs produce innovation infrastructure such as software libraries, tools, and databases. Second, these innovation resources tend to stand out for their flexibility. CE software, for instance supports numerous hardware architectures, software platforms, communication protocols, and file formats. Third, CEs make their resources available in the form preferred by follow-on innovators and potential competitors. They provide not only binary software programs but also the source code they were built from; they provide not only free encyclopedic articles or street maps but also the content databases and the software needed for use and development. For instance, the Wikipedia project makes not only its encyclopedic content freely available but also the Wiki software specifically written for Wikipedia.

These fundamental distinctions of CE output are not necessarily appealing to end users, but crucial to those who want to adapt the resource for their own products or influence its further development. CE output is what Zittrain (2008) called generative: general-purpose technologies and resources that can be freely used and repurposed.

2.2. How Are Resources Produced in Community Enterprises?

Community Enterprises produce polycentric and barrier-free. Polycentric governance is characterized by many centers of decision making, which are formally independent of each other (Ostrom *et al.*, 1961). Consequently, no actor is in a position to control development by prohibiting the use, adoption, or expansion of the resource. Within CEs, some individuals and groups may exert substantial influence over a project, but they do so only as long as contributors choose to respect their decisions voluntarily. Informal, benevolent dictators (e.g., Linus Torvalds for the Linux kernel) or a formally elected community council (e.g., in the umbrella organizations of Wikipedia and Apache) does not have the task of central planning and control but is more concerned with facilitating collaboration, coordination, and conflict resolution between a multitude of autonomous and independent groups.

Community Enterprises maintain polycentric governance characterized by diversity and independence because they are barrier-free. Open licenses give permission to anyone to use and improve the resource to fit their own needs. Therefore, central command and control and the exclusion of divergent views are not possible. Because CEs do not need to secure control about their resources, they have no need for borders separating the enterprise from the rest of the world. They provide barrier-free access to the resources as well as to the tools and processes that create them. Loose structures and informal processes are characteristic for this kind of enterprise.

Community Enterprises also meet the four conditions for collective intelligence or the 'wisdom of crowds', as outlined in Surowiecki (2004), namely diversity, independence, decentralization, and aggregation. First, the diversity of opinions and backgrounds among CE contributors is remarkably high. There are no barriers based on formal qualifications, geographic location, or corporate affiliations. Second, contributors to CEs remain independent. There is no expectation for CE contributors to work for a specific (or any) company, to live in close proximity to each other, or

to keep unapproved opinions to themselves or within the group. The diversity of locations, affiliations, and development goals is thus preserved. Third, decision making in CEs is decentralized. Groups and individuals involved in a project extend the resource at their own discretion, on the basis of their local knowledge, perspective, or interests; coordination with others is voluntary rather than mandatory. Fourth, CEs have mechanisms in place to aggregate information and contributions from their many contributors. A prominent example is the Wiki software that enables many authors to edit texts collaboratively.

Given the lack of hierarchy and control combined with the diversity of interests, it may surprise that CEs are social communities that often develop a strong identity. Although conventional organizational theory argues that identity requires well-defined boundaries (e.g., Schreyögg and Sydow, 2010), CEs have no boundaries that would separate members from non-members or the system from the environment. Despite their heterogeneity and loose structure, identity is conveyed by the nature of the created resources, project histories, cultures, and the ongoing interactions between people involved in the projects. For instance, the goal of building a free encyclopedia contributes to a shared identity, as do discussions on project-related talk pages and mailing lists. In CEs, affiliation is acquired on the one side through interactions with the shared resources and on the other side through behavior considered appropriate for the CEs, not by boundaries. People and organizations usually do not become formal members; rather, they become associated with a CE by using the resource, participating in discussions, promoting the project, or contributing to its further development. In a CE, individuals are affiliated simply by acting and interacting accordingly.²

How resources are produced in CEs is particularly relevant for a central problem of organizations: the agency problem. Traditional organizations acquire control over a collection of complementary resources to gain a competitive advantage (e.g., Zenger *et al.*, 2011). If they are successful, not only the value of an organization's assets rises but also the potential payoff for opportunistic behavior. In order to prevent the misappropriation of valuable assets, increasingly strong governance systems are necessary. In contrast, CEs can operate with lightweight, informal governance structures. Even when they are highly successful, they have few valuable assets that could serve as an incentive for opportunistic behavior. There is no need for central institutions to monitor behavior. Therefore, CEs are largely immune to agency problems.

In summary, CEs replace the characteristic instruments of firms, central planning and control with polycentric, overlapping governance. CEs do not provide incentives toward the implementation of a central plan. Instead, they offer opportunities and tools to anyone for working on a resource. Barrier-free access and polycentric governance preserve the conditions for collective intelligence and a wide variety of motives. CEs offer barrier-free access to production processes and resources that usually remain closed for reasons of competitiveness and organizational effectiveness.

2.3. Why Are Resources Produced in Community Enterprises?

In contrast to for-profit enterprises, the goal of CEs is to provide freely available resources, not to control and appropriate the utility of the resources they create and develop. With CEs, institutions and processes are designed to prevent anyone, including the creators themselves, from gaining authority over the use and further development of the resource. Therefore, control is eliminated as an incentive for creating a resource. This raises the questions: why are resources produced in CEs? More precisely, why do individuals contribute as suppliers to CEs without external incentives? Which qualities make the products of CEs attractive on the demand side?

Individuals as suppliers of generative resources to CEs are driven by a diverse mix of motivations to participate in a collaborative activity. According to Osterloh and Frey (2000), Lindenberg (2001), and Lindenberg and Foss (2011), this mix consists of three types of motivation that do not exclude each other but consist of different frames that can be activated to a different degree. The three types of motivational frames are described as extrinsic motivation, enjoyment-based intrinsic motivation, and obligation-based intrinsic motivation.³

Extrinsic motivation refers to an activity that is done in order to obtain a separable outcome, such as money and material rewards (Deci and Ryan, 2000). *Intrinsic motivation*, on the other hand, is based on the satisfaction an individual derives from involvement in an activity without external rewards. *Enjoyment-based intrinsic motivation* refers to a satisfying flow of activity. Examples are playing a game or solving an interesting puzzle. It is often reported that people feel this kind of motivation, for example, in research (Amabile, 1996) or during innovative software programming (Torvalds and Diamond, 2001). In each case, pleasure is derived from the activity itself, which

provides a 'flow experience' during which individuals often lose track of time (Csikszentmihalyi, 1975). *Obligation-based intrinsic motivation* refers to an activity with the goal to act appropriately. When obligation-based intrinsic motivation drives individuals, they follow norms for pro-social reasons. In particular, they take the well-being of others into account without expecting a reward. The welfare of the community enters into the preferences of the individuals. Although the standard economic model of human behavior—the *homo economicus*—usually is based on the assumption of self-interested, extrinsically motivated individuals, a growing body of empirical evidence indicates that many people are prepared to contribute voluntarily to the community of which they feel a part (e.g., Frey and Jegen, 2001; Fehr and Fischbacher, 2002; Frey and Meier, 2004; Frost *et al.*, 2010).

All three types of motivations are found in CEs. Many CE contributions are due to *extrinsic* rewards such as remuneration, reputation, education, or to serve own needs. For instance, today the majority of Linux kernel development is carried out by paid developers. Shah (2006) found that improvements to existing CE software often are driven by need; the creators, as it is often phrased, 'scratch their own itch'. *Enjoyment-based intrinsic motivation* is evident in the very title of Torvalds and Diamond's (2001) 'Just for Fun: The Story of an Accidental Revolutionary'. Lakhani and Wolf (2005) found that feeling creative was the strongest driver among their respondents. *Obligation-based intrinsic motivation* is also frequently found in CEs. Again, this is evident from the biographies of seminal figures such as Richard Stallman (Williams, 2002) as well as from surveys. Many contributors adhere to internal self-concepts when sharing information (Yang and Lai, 2010); highly engaged Wikipedia contributors report little individual benefits but an interest in sharing information or a desire to create a positive heritage for future generations (Schroer and Hertel, 2009).

Intrinsic motivation of either type is indispensable for the creation of many public goods. Their presence in CEs can drive large, collaborative productions even if neither governments nor firms are willing or able to pay for the creation of resources that are freely available. Wikipedia, Linux, OpenStreetMap, and many other successful CEs had to rely on intrinsically motivated contributions for their initial growth to obtain momentum. Initially, the projects were experiments. They attracted enthusiasts who were interested in exploring possible directions and processes for developing these resources. Other extrinsic motivations

became prominent only after the CEs had established working processes and had built resources that represented substantial investments (Osterloh and Rota, 2007).

What makes the products of CEs attractive on the demand side is that they provide innovation resources that are and remain free for everyone to use and build upon. Follow-on innovators who invest into a CE resource do not become dependent, because the resource is not controlled by anyone. A firm using Linux, for instance, is using a resource large enough to require the investment of many firms, but no other investor can ever prevent the firm from using that innovation resource to fit their needs. The generative technologies offered by CEs cannot be withdrawn but will remain available under known conditions.

Community Enterprises themselves also contribute to the demand for further freely available innovation resources. They need such resources much more than firms do. For instance, firms can and do buy expensive software tools and other innovation resources, whereas CEs need to find alternatives if they want to attract many contributors. These alternatives are often only available if other CEs create them. Conversely, existing CEs often provide the inspiration, generative technologies, and other innovation resources for new CE projects. Linux was built on a foundation of existing, openly licensed software tools. Wikipedia was built on Linux and other, openly licensed software. Thus, the existence of CEs in some areas creates demand for the expansion of CEs in other areas. A positive feedback loop sets in.

In summary, on the supply side a diverse mix of both intrinsic and extrinsic motivations is responsible for individual contributions to CEs. On the demand side, CEs satisfy the need for technologies and innovation resources that are and remain available to use and improve upon without restrictions.

3. COMMUNITY ENTERPRISES AS ALIENS IN THE MARKET ECONOMY

Community Enterprises face unique challenges because they provide unrestricted access to the resources they produce. Challenges arise from interactions with an economic and legal environment, which not only make CEs aliens to the market economy but also to—at least partly—fierce competitors. In this section, we discuss the perspectives and actions of the major groups that shape and constitute the environment in which CEs operate. We analyze the interactions between CEs and

key actors that create challenges and opportunities faced by CEs. On the one hand, firms, consumers, academia, and governments benefit from CEs and give them some support. On the other hand, they are unstable allies because their support is very limited and often they fight against CEs as competitors. Although CEs contribute a huge amount of value to the economy, they suffer from the fact that they are unable to quantify their contributions with commonly used economic indicators. Consequently, policy decisions tend to ignore or dismiss the interests of CEs, thereby limiting the scope and quality of the resources CEs produce.

3.1. Firms

Firms have played an essential role in the creation and development of CEs—both as allies and antagonists. They are among the main beneficiaries of resources produced by CEs. Startups rely on freely licensed generative technology to get off the ground quickly and cheaply. Former startup companies such as Yahoo, Google, and Facebook remain based on free resources long after having become household names. The allure of FOSS is not limited to Internet service ventures. Manufacturers use FOSS to drive networking equipment and consumer electronics. Financial firms have long been known to rely on FOSS. Even stock exchanges recently switched to FOSS for high-performance transaction processing.⁴

The corporate world has learned to appreciate freely available resources. Many companies find some CE projects beneficial and support selected projects. Corporate sponsors fund the development of some CE projects of which the Linux kernel may be the most prominent example. Among those sponsors are the largest producers of software, semiconductors, consumer electronics, and Internet services. Through its annual Summer of Code program, Google has paid stipends to thousands of students working on hundreds of FOSS projects. Even the parent organization of Wikipedia, which must take great care to prevent any semblance of favoritism or partiality, has corporate benefactors.⁵

However, firms tend to be unstable allies for CEs, because they often conflict with them with regard to four aspects: exclusiveness and appropriation of resources, governance issues, competitive behavior, and regulation.

Concerning appropriation of resources in firms, competitive advantages are gained through ownership or exclusive control of resources. According to the resource-based view, these resources have to be valuable, rare, inimitable, and non-substitutable.

Consequently, firms try to protect their resources by ‘isolating mechanisms’ (Rumelt, 1984) or ‘resource position barriers’ (Wernerfelt, 1984). Such mechanisms and barriers have been created and strengthened through the expansion of intellectual property rights in the past decades. Alert companies learned to construct business models incorporating strong and weak appropriability regimes to their own advantage (Chesbrough, 2006). These appropriability regimes often cause conflicts with CEs. For instance, AT&T in the beginning of the development of Unix collaborated with other firms and universities. However, after the company’s breakup in 1984, AT&T tried to increase Unix licensing revenue. In response, the community rewrote the parts of Unix that were owned by AT&T, creating a free Unix for which no royalties were due.

Because CE resources have a high value, exclusive control over its use would be valuable. Therefore, some firms are not just using the resource for commercial gain, but they try to obtain control over the resource or the CE itself. This defeats the purpose of CEs and meets resistance that often results in measures to prevent such events in the future. These measures tend to have wider implications because they usually indicate license issues that are relevant to many other CEs. The copyleft clause, for instance, was a reaction to firms using free resources but selling improvements as proprietary software (e.g., Osterloh and Rota 2007).

Concerning governance issues, firms appropriate value by directing collective action through planning and control. In contrast, CEs not only purposefully create resources that are and will remain public goods, but also deliberately prevent the type of control over resources that firms use to establish control. By rejecting the notion of exclusive rights over the resource created, CEs reject the measures that are commonly used to establish governance. Even firms that provide substantial resources to CEs cannot fully manage or direct CE projects. Instead they only can offer contributions that serve their goals as well as the goals of the CEs.

Concerning competitive behavior, CEs are competitors to firms in a way that threatens the rules of competition in a market economy.

First, CEs give away an endless supply of their output for free. In contrast, a firm entering a market may operate at lower costs than the incumbent firm, but it will still share the interest in profit maximizing margins. Even if a new firm offers low prices to gain market share, it would usually not give away resources that allowed other firms to follow in its footsteps.

Second, CEs cannot be bought. Their output is not an asset but openly licensed and therefore irrevocably

available to everyone. Some assets, such as trademarks, are often owned by a dedicated non-profit organization; even if a firm came into the possession of such assets, the open license permits the CE to copy the resource and reconstitute it under a new name. This has recently happened after Oracle acquired Sun Microsystems. Through this transaction, Oracle bought also rights to the names of several FOSS projects, for example, OpenOffice.org and Hudson. Most major contributors to the OpenOffice.org project left and continued their work on the office suite under the new name LibreOffice. The community developing the Hudson integration software also reacted negatively. They abandoned the name now claimed by Oracle and rebuilt their CE under the name Jenkins.

Third, CEs increase competition in adjacent fields. As CEs create demand and opportunities for more CE projects, they expand into new fields. Because firms usually appreciate the effect of free resources only if it increases the value of the resources they control (*cf.* Henkel and Baldwin, 2009), they do not appreciate such an expansion of CEs.

Concerning regulation, this is the most significant battlefield between firms and CEs. For instance, CE projects are united in their rejection of software patents, whereas industry lobbyists argue in favor of such patents.⁶ Patents allow firms to keep some control and ownership of the software even if the copyrights are freely licensed. Closely related to software patents is the ongoing debate over the definition of open standards. On the one side, CEs argue that the use of standards should require neither permission nor royalty payments. This argument is supported by governments around the world in recent years by taking steps to favor open standards in their procurement guidelines. On the other side, industry lobbyists argue that the promotion of openly licensed products as well as royalty-free standards is inappropriate. Instead, they argue that governments should 'let the market decide' (*cf.* Spinello, 2003). In their view, governments recognizing the contributions of CEs should behave like firms and should ignore benefits to the public good.

The analysis so far shows that firms cannot adopt the methods and practices of CEs without losing the means of control that make their business models lucrative. However, favorable regulation allows firms to expand their control or weaken the value of resources provided by CEs to the public. For these reasons, there is little support for CEs by firms. Although some firms support selected CEs projects, they do this only insofar as this benefits their control over resources that strengthen their competitive advantage.

3.2. Consumers

Consumers see only very limited benefit from CEs for three reasons. First, CE output is geared to potential contributors and follow-on innovators. Generative resources are more flexible and feature-rich than they are user-friendly, polished, or safe for beginners (*cf.* Zittrain, 2008). With a few exceptions such as Wikipedia and the Firefox web browser, CEs are barely visible to end users. Even Linux is better known for its part in the Internet stock market bubble than as something people would want on their personal computers. Second, the benefits of CEs that affect all consumers are indirect and therefore invisible to consumers. Innovation in websites, consumer electronics, and other areas is built upon CE output, but the role of CEs in providing the resources to Google, Facebook, Apple, and other firms is not generally known. Third, consumers are unlikely to support CEs just to keep competition alive and prices low, even though CEs do have such an effect. In summary, very few CEs offer enough visible benefits to consumers to receive popular support.

3.3. Academia

Academia and CEs pursue similar goals with similar means: They build innovation resources that are publicly available. Many parallels between academia and CEs have been documented (e.g., Bezroukov, 1999; Stallman, 2005). CE projects can be interpreted as applying the principles of academic collaboration outside academia. The idea of building on previous work without having to ask permission is common to both. Like CEs, academia is well known for making results available for others to build upon (*cf.* Nelson, 2004). CEs resemble basic research insofar as their main benefits are diffused externalities that cannot be internalized, such as resources that foster competition of ideas, innovation, and educational experiences that are open to anyone.

However, academia and CEs differ in their priorities. The goal of CEs is to keep its output available for everyone to use and build upon. Therefore, CEs produce only what can be funded without granting exclusive control over results. In contrast, in academia the goal to make scientific outcomes available to everyone is constrained. First, it is constrained by the wish to obtain resources for research. For this purpose, scientists often transfer patent rights that grant exclusive control over their inventions to industry partners. This practice has been encouraged by the Bayh–Dole Act, which allows

scientists to patent inventions that result from publicly funded research.⁷ Second, the goal to make scientific outcome available to everyone is constrained by the wish to get published. For this purpose, scientists transfer their copyrights to publishers who use these rights to make others pay for access.

In sum, scientists do not to provide much support to CEs, although they aim at a wide dissemination of their research results, they have different priorities than CEs.

3.4. Governments

Governments play three different roles for CEs. They are among the largest consumers and producers of generative resources, act as regulators that determine what firms and CEs can do, and oppose tools and processes that governments themselves cannot control.

First, governments, like firms, consumers, and academia, make use of free resources produced in CEs, most notably software. In contrast to the other users, governments are expected to look beyond their direct benefits and consider the interests of the whole economy. In particular, governments should recognize the benefits of generative technologies and innovation resources—such as the Internet—that are available to everyone. Governments can provide funding to CEs by purchasing openly licensed products from firms that have substantially contributed to the respective CEs. Even if the government buys proprietary products, it can help CEs by considering only products that adhere to open standards that anyone can implement without asking permission or paying royalties. This allows everyone—including CEs—to keep their resources and products compatible with the technology used by the government.

Second, governments influence CEs by intellectual property rights that favor firms. These rights have been expanded and strengthened in the past decades. Merges (1995, p. 104) attributes this development ‘to a presumption that any intangible contribution ought to be protected’ and to governments that use intellectual property rights as an ‘apparently fiscally-neutral way to subsidize business interests’. This may disadvantage CEs in several ways. The first disadvantage consists in the fact that the expansion of intellectual property rights increases the opportunity costs for contributors to CEs because it increases the attractiveness of proprietary business models. As a consequence, the extension of copyright terms and the proprietary licensing of publicly funded information reduce the inflow into the public domain pool. The second disadvantage consists in the

consequences of lowering the thresholds of patenting (*cf.* Bessen and Meurer, 2008). In this case, CEs have more difficulties keeping their resources free of veto rights. A third disadvantage appears if current Internet regulations were changed to make CEs liable for the actions of loosely connected volunteers. In this case, these projects would suddenly find themselves in a precarious legal position.⁸ All these kinds of regulations threaten CEs and the value they are creating. Unfortunately, these disadvantages are hardly represented in the process of policy making because CEs have no lobby, due to the reasons discussed in Section 3. The Pirate Parties, which have made headlines in several countries, are the most prominent political movement to criticize the trend toward ever stronger intellectual property rights. But until now, these parties have not gained much political influence. Consequently, the trend in regulation continues to shrink the space where participation in an information society does not require a permit, a license, or a fee.

Third, governments are tasked not only with making rules but also with enforcing them. As creators, promoters, and enforcers of control, governments sometimes have substantial differences with CEs. Governments around the globe would prefer an Internet that is easier to control and regulate than it is now.⁹ They are developing legal and technical instruments to prevent illegal communications and to facilitate the prosecution of offenders. However, a comprehensive enforcement of national laws could undermine the freedoms that allow global CEs to communicate, organize themselves, and produce resources.

In summary, governments on the one hand appreciate the resources produced by CEs and some of the positive externalities that come with these public goods. On the other hand, governments are not supportive of organizational principles that do not allow full control and accountability.

3.5. Selective Support is Insufficient to Sway Public Policy

The groups discussed in the previous sections—firms, consumers, academia, and governments—benefit from the creation of free resources and processes that are open to anyone. They support CEs if, and as long as, they are seen as aligned with their own interests. Therefore, there is no widespread support for the principles underlying CEs although CEs contribute considerably to the wealth of the economy and society. CEs are aliens in the market economy in the same way as similar phenomenon described, for example,

by Lessig (2004), Zittrain (2008), and Wu (2010). Lessig (2004) promotes a 'free culture' that allows follow-on creators and innovators to produce without 'the permission of the powerful, or of creators from the past'. Zittrain (2008) would like to keep technologies such as computers or the Internet generative, that is, flexible and open for anyone to adapt to their needs. On the basis of historical studies of media and information technologies, Wu (2010) sees important benefits in limiting private and governmental control of information content, technologies, and infrastructure.

A common theme among all these writings is a concern that these concepts need protection by law. What sets CEs apart from these related concepts is that CEs actively promote their principles. They create prominent artifacts that showcase the benefits of open and uncontrolled systems, by acting as a catalyst for them and simultaneously improving the availability of resources for everyone. Enabling CEs may be the most effective way of supporting the qualities and goals promoted by the authors such as Lessig (2004), Zittrain (2008), and Wu (2010).

Although CEs show that public goods of huge value can be provided despite a lack of control, but instead because of a lack of control, they can easily be damaged. In particular, the lack of support in public policy for these principles poses the biggest challenge to CEs.

4. IMPLICATIONS FOR RESEARCH

In this section, we discuss the theoretical implications of these developments for standard economics and for the theory of the firm that is based on standard economics. We look at assumptions that are at odds with the insights gained by studying CEs and that hinder the analysis of CEs in order to grasp its potential as a source of institutional innovation and economic value.

First, externalities usually are considered a problem. The internalization of external effects has become the remedy in standard economics. Intellectual property rights are one prominent example. By making a formerly public good excludable, they enable investors to appropriate utility that would otherwise be a positive externality of their work. However, the existence of CEs show that, in some cases, internalizing external effects is less desirable than leaving the public good non-excludable. This insight is supported by spillover theory (Frischmann and Lemley, 2007; Frischman, 2009), which currently is not considered part of standard economics.

A second assumption favors strong property rights and extends this view to intellectual property rights, although there is notoriously inconclusive empirical evidence on whether intellectual property rights are beneficial or not (e.g., Landes and Posner, 2003; Bessen and Meurer, 2008).¹⁰ The assumption of the advantages of strong intellectual property rights contradicts the fact that CEs create value by deliberately producing resources that are not owned by anyone.

A third assumption that makes CEs fit badly into the economic discourse is the nature of innovation. Going back to Joseph Schumpeter, producer firms are viewed as the primary source of innovation (Baldwin and von Hippel, 2009). These assumptions do not hold when CEs are concerned. The Internet, for instance, which was built on non-proprietary technology, became a hotbed for commercial and non-commercial innovation by allowing anyone to enter the competition for attention and purchasing power. As an innovative force, however, it remains hard to capture within the constraints of a standard economic understanding of innovation.

Fourth, a theory of the firm that is focused on the question what determines the boundaries of the firm cannot grasp the characteristics of an enterprise that is boundary-free such as CEs. This is in particular problematic, as in most articulations of the theory of the firm their boundaries are defined as the capacity of a central decision maker to exert authority. In CEs, such an authority does not exist. This might be the reason why overviews over the theory of the firm do not even mention the existence of CEs or related communities (e.g., Zenger *et al.*, 2011).

Inappropriate assumptions establish an additional burden for research of new phenomena compared with established ones. First, in the light of conventional theories, new phenomenon such as CEs is underestimated. This is in particular the case when the conventional proxies for economic activities such as GDP, the number of employees, profit, R&D expenditures, and patenting activity miss the impact of CEs on the economy almost entirely. Second, it is not possible to determine the conditions that favor the emergence of CEs as long as the theory of firms is not extended into a comprehensive theory of enterprises that embraces firms as well as CEs. Third, if current theories fail for CEs, this will go unnoticed by conventional studies because CEs are usually not part of the samples. Fourth, the international harmonization of innovation laws makes empirical research difficult; the decreasing diversity of legal regimes destroys opportunities to study their different effects (*cf.* Reichmann and

Dreyfuss, 2007). Fifth, regulatory efforts are underway that would close the window of opportunity for organizations such as CEs. A self-fulfilling prophecy sets in Ferraro *et al.* (2005).

Two consequences for research arise. First, assumptions need to be checked for biases that hinder to understand the new phenomenon. Second, alternative indicators should be looked for, that are more adequate to grasp the activities and outcomes of CEs. Examples could be the measurement of happiness (Frey and Stutzer, 2002; Layard, 2005; Frey, 2008) or capabilities (Nussbaum and Sen, 1993). In summary, we need a comprehensive theory of enterprises that explains the existence of firms as well as the existence of CEs.

5. IMPLICATIONS FOR PUBLIC POLICY

We have discussed why CEs and their principles find little support in public policy that tends to favor firms. In this section, we ask whether policy should concentrate on regulations in the market or whether governments could be more successful when they use their discretion as buyers, sponsors, and producers of goods to enable CEs.

5.1. Regulating Control in Markets

Many policy recommendations in favor of CES and other open systems aim at regulating the market to rein in controlled systems. There are several recommendations in that direction.

The most prominent recommendations are about control exerted through intellectual property rights. Calls to stop or revert the ongoing expansion and strengthening of these rights have the advantage of being popular in academia.¹¹ However, widespread protests have so far at best managed to slow the rate at which legislation favoring intellectual property is passed. Any legislature trying to curb such rights would find that international treaties make it hard to do so. In addition, relevant control issues are not limited to intellectual property but extend to private physical property, where government interventions are particularly ill-received. Net neutrality, for instance, would limit the ability of network operators to interfere with the traffic flowing through their own infrastructure (Wu, 2010).

Whether any of these proposals are implemented is unclear. The widely denounced retroactive extensions of copyright terms in both the USA and the EU suggest that the opposition is very strong. Economic

history shows that undesirable developments in fast-moving markets are very hard to correct through market regulations (*cf.* May and Sell, 2006).

5.2. Supporting CEs by Procurement and Sponsoring

Other policy proposals rely on the government's discretion as a buyer, sponsor, and producer of goods. These proposals focus on how the government can support the creation and growth of CEs through its own transactions and activities.

First, government can foster CEs by procurement policies. These policies should focus on products adhering to open royalty-free standards that foster the development and use of such standards. This measure enables CEs to build compatible alternatives.

Second, government can make its own resources freely available in order to give all actors equal access to the results of publicly funded work. A prominent example is the policy that forgoes copyright protection for all works made by the US government and its agencies.

Third, government should revert its policy to dry up the flow of government-funded research and technologies that gave the world the Internet and, some years later, the World Wide Web. Such distributed architecture stands in stark contrast to the communications networks designed by industry research. Unfortunately, the Bayh–Dole Act (and similar laws in other jurisdictions) encouraged patents on government-funded research, whereas grant schemes make researchers depend on income from signing over exclusive control over their inventions. It may not be possible to revert these developments entirely, but policy makers can provide alternative means of funding to those researchers and institutions that make their results freely available.

Such recommendations, too, will meet with resistance. However, governments have more discretionary power with regard to their own conduct, compared with regulations of transactions in the market.

This proposal has the additional advantage that single nations can make a significant difference. Having some countries without software patents or shorter copyright terms is of limited help to globally distributed projects. To take advantage of such differences, CEs would need to exclude users or contributors from some countries or work on different editions of their resources. For instance, some images in a Wikipedia article or some technologies available in the Linux kernel would only be available to users and contributors

in some countries. However, if one country insists on open standards or makes publicly funded works freely available, it has a substantial impact because the benefits are available to CEs worldwide.

In conclusion, the easiest—and a proven—way to support CEs appears to be through terms and conditions on government procurement and funding.

6. CONCLUSIONS

Management and innovation research has long focused on studying for-profit organizations that produce privately owned resources based on central authority and within well-defined boundaries. However, other kinds of enterprises have risen to prominence in the past decade. The literature on commons has shown that collectively owned resources can be successfully managed by self-organized, polycentric governance (Ostrom, 1990, 2010; Powell, 1990). However, these enterprises are still exclusive clubs, based on strong personal relationships or well-defined boundaries, respectively. They control physical, relational, or other resources solely for the benefit of their members.

In recent times, a new kind of enterprise has emerged that creates immense economic value although this value is hard to measure. We call it CE because it is an enterprise with a purpose and an identity that operates in direct competition to conventional enterprises. Community enterprises are barrier-free. They are characterized by the production of appropriation-free resources and the absence of boundaries. They produce resources that are not controlled by anyone. Such resources enable sustained innovation because they permit follow-on innovators to create without needing permission. Numerous firms, particularly in the growing Internet and information technology industries, make use of these resources. However, CEs collide with for-profit firms frequently because they are based on principles that are alien to a market economy. Whereas firms try to expand the control they can exert over valuable resources, CEs prevent control over resources. This erodes the margins in lucrative markets. Therefore, CEs find little support in public policy, even though firms, consumers, and academia benefit greatly from them.

Although the importance of CEs is widely recognized, until now conventional economics and the theory of the firm do not contribute much to explain their success. We analyze how the assumptions of conventional theories hinder the analysis of CEs to grasp their potential as a source of economic value.

We also analyze which public policy measures are able to support CEs. We find that the easiest way to do so is through terms and conditions of government procurement and funding.

Acknowledgement

The authors thank Emil Inauen for helpful discussions and comments.

NOTES

1. 'Linux Kernel Development: How Fast it is Going, Who is Doing It, What They are Doing, and Who is Sponsoring it' available at <http://go.linuxfoundation.org/who-writes-linux-2012> (March 2012). 'Wikipedia Statistics' available at <http://stats.wikimedia.org/EN/TablesWikipediansEditsGt5.htm> (last visited 28 May 2012).
2. Insofar CEs resemble research communities.
3. We prefer the concept of different motivational frames provided by Lindenberg (2001) and Lindenberg and Foss (2011) to the concept of a motivation continuum provided by Gagné and Deci (2005), because it fits better the question how to motivate individuals within teams.
4. 'London Stock Exchange Linux record breaking system faces new challengers' available at <http://www.computerworlduk.com/in-depth/open-source/3246835/> (last visited 2 November 2010).
5. <http://wikimediafoundation.org/w/index.php?title=Benefactors&oldid=58505>
6. Among the proponents of software patents are many of the major corporate sponsors of FOSS projects.
7. More than a quarter century after its enactment, the Bayh–Dole Act is as controversial as ever. Its supporters consider it a successful improvement to the transfer of technology from universities to the industry, whereas critics say the Bayh–Dole Act has damaged the innovation system and the nature of public science. See Boettiger and Bennett (2006) for a summary of the controversy.
8. The regulations that protect CEs were initially created to protect Internet hosting providers from liability for the content they distribute on behalf of their customers. Courts have interpreted these regulations to also protect CEs, even if they cannot identify the contributor of objectionable content (*cf.* Myers 2006).
9. Governments differ in how they plan to make use of control over the Internet, but the desire for better control appears to be universal, whether it is to keep the population from organizing protests, to prevent the leaking of confidential documents, to protect the youth from harmful material, or to enforce intellectual property rights better.
10. This should not be entirely surprising, as some authors have made a strong case that the well-documented benefits of private property in material goods do not extend to immaterial goods. These authors argue that intellectual property does not and cannot function like physical property, not even for firms (e.g., Menell 2007; Bessen and Meurer, 2008).
11. Public statements to that effect include Amici Curiae brief of George A. Akerlof *et al.* as Amici Curiae in

Eldred v Ashcroft, 20 May 2002; The Public Domain Manifesto (2010) available at <http://www.publicdomainmanifesto.org/>; Geneva Declaration on the Future of the World Intellectual Property Organization (2004) available at <http://www.cptech.org/ip/wipo/genevadeclaration.html>; and Declaration on a Balanced Interpretation of the ‘Three-Step Test’ in Copyright Law (2008) available at http://www.ip.mpg.de/ww/en/pub/news/declaration_on_the_three_step_.cfm

REFERENCES

- Amabile TM. 1996. *Creativity in Context: Update to the Social Psychology of Creativity*. Westview Press: Boulder, CO.
- Baldwin CY, von Hippel EA. 2009. Modeling a paradigm shift: from producer innovation to user and open collaborative innovation. *Working Paper 10–038*, Harvard Business School Finance. 25 November 2009.
- Benkler Y. 2002. Coase’s penguin, or, Linux and “The Nature of the Firm”. *The Yale Law Journal* **112**(3): 369–446.
- Benkler Y. 2004. Sharing nicely: on shareable goods and the emergence of sharing as a modality of economic production. *The Yale Law Journal* **114**(2): 273–358.
- Benkler Y. 2006. *The Wealth of Networks: How Social Production Transforms Markets and Freedom*. Yale University Press: New Haven and London.
- Bennis WG, O’Toole J. 2005. How business schools lost their way. *Harvard Business Review* **83**(5): 96–104.
- Bessen J, Meurer MJ. 2008. *Patent Failure: How Judges, Bureaucrats, and Lawyers Put Innovators at Risk*. Princeton University Press: Princeton and Oxford.
- Bezroukov N. 1999. Open source software development as a special type of academic research (critique of vulgar Raymondism). *First Monday* **4**(10), <http://firstmonday.org/article/view/696/606>.
- Boettiger S, Bennett AB. 2006. Bayh–Dole: if we knew then what we know now. *Nature Biotechnology* **24**(3): 320–323.
- Boyle J. 2008. *The Public Domain: Enclosing the Commons of the Mind*. Yale University Press: New Haven and London.
- Chesbrough H. 2006. *Open Business Models: How to Thrive in the New Innovation Landscape*. Harvard Business Press: Boston.
- Corley KG, Gioia DA. 2011. Building theory about theory building: what constitutes a theoretical contribution? *Academy of Management Review* **36**(1): 12–32.
- Csikszentmihalyi M. 1975. *Beyond Boredom and Anxiety*. Jossey-Bass: San Francisco.
- Dahlander L, Magnusson M. 2008. How do firms make use of open source communities? *Long Range Planning* **41**(6): 629–649.
- Deci EL, Ryan RM. 2000. The “what” and “why” of goal pursuits: human needs and the self-determination of behavior. *Psychological Inquiry* **11**(4): 227–268.
- Demil B, Lecocq X. 2006. Neither market nor hierarchy nor network: the emergence of bazaar governance. *Organization Studies* **27**(10): 1447–1466.
- Fehr E, Fischbacher U. 2002. Why social preferences matter—the impact of non-selfish motives on competition, cooperation and incentives. *The Economic Journal* **112**(478): C1–C33.
- Ferraro F, Pfeffer J, Sutton RI. 2005. Economics language and assumptions: how theories can become self-fulfilling. *Academy of Management Review* **30**(1): 8–24.
- Frey BS. 2008. *Happiness: A Revolution in Economics. Munich Lectures in Economics*. MIT Press: Cambridge and London.
- Frey BS, Jegen R. 2001. Motivation crowding theory. *Journal of Economic Surveys* **15**(5): 589–611.
- Frey BS, Meier S. 2004. Social comparisons and pro-social behavior: testing “Conditional Cooperation” in a field experiment. *American Economic Review* **94**(5): 1717–1722.
- Frey BS, Stutzer A. 2002. What can economists learn from happiness research? *Journal of Economic Literature* **40**(2): 402–435.
- Frischmann B. 2009. Spillovers theory and its conceptual boundaries. *William & Mary Law Review* **51**(2): 801–824.
- Frischmann BM, Lemley MA. 2007. Spillovers. *Columbia Law Review* **107**(1): 257–301.
- Frost J, Osterloh M, Weibel A. 2010. Governing knowledge work: transactional and transformational solutions. *Organizational Dynamics* **39**(2): 126–136.
- Gächter S, von Krogh G, Haefliger S. 2010. Initiating private-collective innovation: the fragility of knowledge sharing. *Research Policy* **39**(7): 893–906.
- Gagné M, Deci EL. 2005. Self-determination theory and work motivation. *Journal of Organizational Behavior* **26**(4): 331–362.
- Hansen S, Berente N, Lyytinen K. 2009. Wikipedia, critical social theory, and the possibility of rational discourse. *The Information Society* **25**(1): 38–59.
- von Hayek FA. 1975. The pretence of knowledge. *The Swedish Journal of Economics* **77**(4): 433–442. Nobel Memorial Lecture held 11 December 1974.
- Henkel J. 2006. Selective revealing in open innovation processes: the case of embedded Linux. *Research Policy* **35**(7): 953–969.
- Henkel J, Baldwin C. 2009. Modularity for value appropriation: drawing the boundaries of intellectual property. *Working Paper 09–097*, Harvard Business School.
- Jeppesen LB, Lakhani KR. 2010. Marginality and problem-solving effectiveness in broadcast search. *Organization Science* **21**(5): 1016–1033.
- von Krogh G, von Hippel E. 2006. The promise of research on open source software. *Management Science* **52**(7): 975–983.
- Lakhani KR, Wolf RG. 2005. Why hackers do what they do: understanding motivation and effort in free/open source software projects. In *Perspectives on Free and Open Source Software*, Feller J, Fitzgerald B, Hissam SA, Lakhani KR (eds). MIT Press: Cambridge and London; Chapter 1, 3–21.
- Landes WM, Posner RA. 2003. *The Economic Structure of Intellectual Property Law*. Harvard University Press: Cambridge and London.
- Layard R. 2005. *Happiness: Lessons from a New Science*. Penguin Press: New York.
- Lee D, Mendelson H. 2008. Divide and conquer: competing with free technology under network effects. *Production and Operations Management* **17**(1): 12–28.
- Lerner J, Tirole J. 2002. Some simple economics of open source. *The Journal of Industrial Economics* **50**(2): 197–234.

- Lessig L. 2004. *Free Culture*. Penguin Press: New York.
- Lindenberg S. 2001. Intrinsic motivation in a new light. *Kyklos* **54**(2/3): 317–342.
- Lindenberg S, Foss NJ. 2011. Managing joint production motivation: the role of goal-framing and governance mechanisms. *Academy of Management Review* **36**(3): 500–525.
- May C, Sell S. 2006 *Intellectual Property Rights: A Critical History*. Lynne Rienner: London.
- Menell PS. 2007. The property rights movement's embrace of intellectual property: true love or doomed relationship? *Ecology Law Quarterly* **34**(2): 713–754.
- Merges R. 1995. The economic impact of intellectual property rights: an overview and guide. *Journal of Cultural Economics* **19**(2): 103–117.
- Müller C, Gurevych I. 2009. Using Wikipedia and Wiktionary in domain-specific information retrieval. In *Evaluating Systems for Multilingual and Multimodal Information Access, Lecture Notes in Computer Science*, Peters C et al. (eds). Springer: Berlin, Heidelberg, New York; 219–226.
- Myers KS. 2006. Wikimmunity: fitting the Communications Decency Act to Wikipedia. *Harvard Journal of Law and Technology* **20**(1): 163–208.
- Nelson RR. 2004. The market economy, and the scientific commons. *Research Policy* **33**(3): 455–471.
- Nussbaum MC, Sen A (eds.). 1993. *The Quality of Life*. Oxford University Press: Oxford and New York.
- Osterloh M, Frey BS. 2000. Motivation, knowledge transfer, and organizational forms. *Organization Science* **11**(5): 538–550.
- Osterloh M, Rota S. 2007. Open source software development: just another case of collective invention? *Research Policy* **36**(2): 157–171.
- Ostrom E. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action. Political Economy of Institutions and Decisions*. Cambridge University Press: Cambridge and New York.
- Ostrom E. 2010. Beyond markets and states: polycentric governance of complex economic systems. *American Economic Review* **100**(3): 641–672.
- Ostrom V, Tiebout CM, Warren R. 1961. The organization of government in metropolitan areas: a theoretical inquiry. *American Political Science Review* **55**(4): 831–842.
- Powell WW. 1990. Neither market nor hierarchy: network forms of organization. *Research on Organizational Behavior* **12**: 295–336.
- Reichman JH, Dreyfuss R. 2007. Harmonization without consensus: critical reflections on drafting a substantive patent law treaty. *Duke Law Journal* **57**(1): 85–130.
- Rosenzweig R. 2006. Can history be open source? Wikipedia and the future of the past. *The Journal of American History* **93**(1): 117–146.
- Rumelt RP. 1984. Towards a strategic theory of the firm. In *Competitive Strategic Management*, Lamb RB (ed.) Prentice-Hall: Englewood Cliffs; 556–570.
- Schreyögg G, Sydow J. 2010. Organizing for fluidity? Dilemmas of new organizational forms. *Organization Science* **21**(6): 1251–1262.
- Schroer J, Hertel G. 2009. Voluntary engagement in an open web-based encyclopedia: Wikipedians and why they do it. *Media Psychology* **12**(1): 96–120.
- Shah SK. 2006. Motivation, governance, and the viability of hybrid forms in open source software development. *Management Science* **52**(7): 1000–1014.
- Spinello RA. 2003. The future of open source software: let the market decide. *Journal of Information, Communication & Ethics in Society* **1**(4): 217–233.
- Stallman R. 2005. Free community science and the free development of science. *PLoS Medicine* **2**(2): e47.
- Surowiecki J. 2004. *The Wisdom of Crowds*. Doubleday: New York and London.
- Torvalds L, Diamond D. 2001. *Just For Fun: The Story Of An Accidental Revolutionary*. Harper Business: New York.
- Wernerfelt B. 1984. A resource-based view of the firm. *Strategic Management Journal* **5**(2): 171–180.
- Williams S. 2002. *Free as in Freedom: Richard Stallman's Crusade for Free Software*. O'Reilly: Sebastopol.
- Wu T. 2010. *The Master Switch: The Rise and Fall of Information Empires*. Knopf: New York.
- Yang H-L, Lai C-Y. 2010. Motivations of Wikipedia content contributors. *Computers in Human Behavior* **26**(6): 1377–1383.
- Zenger TR, Felin T, Bigelow L. 2011. Theories of the firm–market boundary. *The Academy of Management Annals* **5**(1): 89–133.
- Zittrain J. 2008. *The Future of the Internet—And How to Stop It*. Yale University Press: New Haven and London.